REMARKS

With entry of the foregoing amendment, Claims 1-36 are still pending in the application. No claim has yet been allowed.

The Specification has been amended at various paragraphs on pages 6 through 9 as described in the Amendments to the Specification section to correct typographical errors associated with the reference labels and elements for Fig. 1. All of the amendments are supported by Fig. 1 of the originally filed Application and no new matter is added.

Claims 1-36 were provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of Claims 1-36 of co-pending U.S. Patent Application No. 10/196,569. To overcome the provisional double patenting rejection, the Applicant has canceled original Claims 1-36 within the co-pending Application No. 10/196,569 which, therefore, eliminates any claims that may have been coextensive in scope with Claims 1-36 of this Application.

Thus, the Applicant respectfully requests that the rejection of Claims 1-36 under 35 U.S.C. 101 be withdrawn.

Claims 1-35 were also rejected under 35 U.S.C. 103(a) as being unpatentable over Roh et al. (U.S. Patent 6,249,517) in view of Zehavi (U.S. Patent 5,414,728). Claim 36 was rejected under 35 U.S.C. 103(a) as being unpatentable over Roh et al. in view of Zehavi and Hiramatsu (U.S. Patent 6,266,363).

The present invention relates to a Code Division Multiple Access (CDMA) communications system in which each user within one group of terminals uses a unique long Pseudorandom Noise (PN) code sequence to establish a unique logical communications channel with a base station. Users within a second group, however, share a unique long PN code sequence. To establish a unique logical communications channel for each user within the second group, each user is further assigned a unique orthogonal or near-orthogonal spreading code. By using an orthogonal spreading code such as a Walsh code, overall system noise is also minimized to improve overall system capacity. The system may further employ short PN codes to enable each terminal within either the first or second groups to distinguish communications from one particular base station from other base stations within the terminal's vicinity.

To understand the code offset or code phase offset, it is important to understand how a PN sequence is generated. In an IS-95B system, a 42-bit Linear Feedback Shift Register (LFSR) is used to generate the long PN code sequence. Every terminal in an IS-95B system uses the same LFSR that generates the same long PN code sequence. Mathematically, the sequence is produced by the modulo-2 inner product of a 42-bit mask and 42-bit state vector of the LFSR which is defined by following characteristic the polynomial: $p(x) = x^{42} + x^{35} + x^{33} + x^{31} + x^{27} + x^{26} + x^{25} + x^{22} + x^{21} + x^{19} + x^{18} + x^{17} + x^{16} + x^{10} + x^{7} + x^{6} + x^{5} + x^{3} + x^{2} + x + 1$. At a chip rate of 1.2288 Mcps, the long PN code sequence, with a period of $2^{42} - 1$, begins to repeat itself after approximately 41.4 days.

When a terminal initially originates a call in an IS-95B system, the 42-bit mask is derived, at least in part, from the terminal's unique electronic serial number (ESN). Thus, the 42-bit mask is unique for every terminal because the ESN is unique for every terminal. Because every terminal is using the same long PN code sequence, the 42-bit mask uniquely defines the initial state or phase of the long PN code sequence. Therefore, it is the initial state or phase of the common long PN code sequence that determines the unique logical communications channel between a terminal and base station (on the reverse link).

By analogy, one can think of the long PN code sequence as a loop race track where start and finish are the same position, i.e., the PN code sequence eventually repeats itself. The terminals are analogous to cars that are initially located at various positions within the race track, i.e., each car's initial position on the race track corresponds to the initial state or phase of the long PN code sequence for each terminal as determined by the long code mask. Thus, as all of the cars move (i.e., terminals communicate with the base station) at the same speed on the race track (i.e., the same chip rate), they maintain the same relative distance from each other while their position (i.e., phase offset) changes on the track in relation to time. Generally, the terms code offset, phase offset, code phase offset, phase shift, time offset, sequence state, and phase in relation to a PN code sequence are interchangeably used to refer to the state of the PN code sequence at a particular time.

The same analogy applies to the short PN sequence in an IS-95B system except that the race track is much shorter. With a 2^{15}-1 period, the short PN sequence repeats itself every 26.67 ms. Also, a common offset or initial state for the short PN code sequence is associated with each

base station in an IS-95B system to allow terminals to distinguish simultaneous communications from multiple base stations.

In one embodiment of the present invention, a unique offset of a common PN code sequence is shared by all the terminals of a second group for reverse link communications with a base station while a unique offset of a common PN code sequence is used by each terminal of a first group for reverse link communications with a base station. To define a unique reverse link communications channel for each terminal in the second group with a base station, the present invention advantageously assigns an additional unique orthogonal spreading code to each terminal that is applied to reverse link communications with a base station. Thus, the terminals of the second group only use one unique offset of the common PN code sequence and, effectively, "use up" only one logical communications channel from the first group's perspective, while actually occupying uniquely defined logical communications channels based on the unique orthogonal spreading code assigned to each terminal.

As shown in Fig. 3 of the Application, the present invention, in one embodiment, applies three spreading codes to digital signal 402 for terminals within the second group: 1) a short PN codes with a common offset for a particular base station, 2) a unique orthogonal Walsh code to define a unique logical communications channel for each terminal in the second group, and 3) a long PN code sequence with an unique offset shared by the second group of terminals. It is important to note that the offset shared by the second group is a unique offset from the base station's perspective. Thus, a third group could be assigned another unique offset for the long PN code sequence that is shared by all the terminals of the third group. A fourth group could be assigned another unique offset, and so on.

In contrast, the Roh et al. patent describes a single CDMA transmitter apparatus with the ability to operate in two modes: 1) using an unique orthogonal spreading code with a long PN code sequence having a fixed code offest "allocated to the corresponding cell or sector" when an optimal modulation rate is used or 2) using a long PN code sequence with a unique offset (col. 4, lines 10-12). As shown in Fig. 2, a single terminal uses a switching controller 29 to apply orthogonal spreader 25 depending on the digital bit rate, chip rate, and length of the orthogonal code. If the "product of the digital bit rate and the length of the orthogonal code is equal to the chip rate," switch controller 29 applies an orthogonal spreading code to the traffic signal using

orthogonal spreader 25 along with a long PN code sequence with a fixed code offset on the I and Q channels (col. 4, lines 3-12). If the product is not equal to the chip rate, switch controller 29 bypasses orthogonal spreader 25 and a long PN code sequence with a unique offset is applied to the traffic data on the I and Q channels (col. 4, lines 13-22).

As shown in Fig. 2, when the orthogonal spreader 25 is applied, the Roh et al. patent simply applies two spreading codes to a data input: 1) a long PN code with a common offset for a particular base station and 2) a unique orthogonal Walsh code to define a unique logical communications channel for the terminal. The apparatus of Roh et al. does not imply or suggest using a long PN code with an unique offset that is shared by a second group of terminals, as recited in Claim 1.

The Zehavi patent describes a CDMA system that provide in-phase (I) and quadrature phase (Q) spread spectrum communication channels through which a first and second information signal are transmitted respectively. Because the quadrature phase is 90 degrees offset from the in-phase signal, signals at one phase do not interfere with signals at the other phase. Thus, by using the I and Q phase channels, a digital communications terminal can transmit information at twice the data rate or simultaneously transmit the information of two users over the separate I and Q phases respectively.

As shown in Fig. 3, the Zehavi patent applies a PN sequence to the I and Q channels. The same PN sequence with the same offset may be used for a single terminal using both channels. Otherwise, "in the case where the I and Q channels are assigned to different users, the long PN scrambling code are preferably different e.g. ...the same code sequence but of different code phase offsets" (col. 6, lines 60-65). As explained previously, the "code phase offset" referred to in Zehavi is equivalent to the term "code offset" described in Roh et al, as they both refer to the state of the PN code sequence. Thus, it was not necessary for the Examiner to cite Zehavi, since it adds nothing more than Roh et al. Furthermore, it is important to note that the 90 degree phase shift between the I (sine) and Q (cosine) modulation channels mentioned in Zehavi is not the same as the code phase offset or code offset related to the PN code sequence.

The Hiramatsu patent describes a CDMA transmitting and receiving apparatus wherein a base station can adaptively assign various amounts of spreading codes, types of spreading codes, or spreading codes of different lengths which may be used on the reverse link depending on the

communications channel quality detected at the base station. For example, when the quality of the reverse link is below some threshold (i.e., bad), the number of spreading codes is reduced, but when the quality of the reverse link is above some threshold (i.e., good), the number of spreading codes is increased (col. 2, lines 60-64).

According to the Examiner, Claim 1 was rejected under 35 U.S.C. 103(a) as being unpatentable over Roh et al. in view of Zehavi, in part, because Roh et al. discloses that an unique "orthogonal code and the long PN code with a fixed or common time offset as the channel-separating and PN spreading code" is used for "Group 2" (See Office Action Page 3, Lines 9-16).

Roh et al., however, does not teach having the PN spreading code applied to traffic channels in a first and second group of terminals. Rather, Roh et al. is only suggesting that the CDMA transmitter in a single terminal be operated in two different modes (either with the orthogonal spreader operative or not). It is clear that the circuit in Fig. 2 of Roh et al. is for a transmitter in a single terminal that chooses whether an orthogonal spreader is activated, depending upon a desired data rate. The Roh et al. patent is not describing a system, such as the Applicant's, in which groups of terminals use different modulation codes according to different predetermined assigned functions, that have nothing to do with the traffic data rate.

Furthermore, Claim 1 of the present Application requires that each user of the second group be assigned a second additional PN spreading code that is used regardless of the desired traffic data rate. This is another difference from Roh et al. which suggests activating orthogonal codes based on a desired data rate, not based on user groupings.

Even if an argument is made that some of the users in a system as suggested by Roh et al. would be operating in the first mode and other sets of users would be operating in the second mode, one does still not arrive at Applicants' invention. As stated in the Roh et al., the "long PN spreading is carried out by the long codes having a fixed time offset allocated to the corresponding cell or sector" (col. 4, lines 10-12). There is no suggestion, however, in Roh et al. of assigning a PN spreading code with a unique code, phase, or time offset that is shared by all users of a second group. This distinction is subtle, but significant, because the present invention allows the second group of terminals to be assigned and share any available unique code offset and appear "as a single legacy user of the first group" (See Application Specification, page 11,

line 16), while Roh et al. requires a terminal that switches to a first spreading mode to use a fixed and common code offset associated with a particular cell or sector.

This distinction is also illustrated by comparing Fig. 2 of Roh et al. with Fig. 3 of the present invention. In Fig. 2 of Roh et al., when a terminal is operating in the first mode, the long PN code sequence, using a fixed offset associated with a cell/sector, is applied to the traffic signal in addition to orthogonal spreading. In Fig. 3 of the present invention, a short PN code sequence with a fixed offset associated with a base station and a long PN code sequence with a unique code offset shared by users of a second group are applied to the traffic signal in addition to orthogonal spreading.

Because each cell/sector is typically associated with a base station in an IS-95 CDMA system, the long PN code sequence using a fixed offset associated with a cell/sector of Roh et al. is equivalent to the short PN code sequence using a fixed offset associated with a base station of the present invention. Whether a long or short PN sequence is used typically depends on non-relevant issues such a user privacy because a longer sequence takes more time to repeat itself. Thus, Fig. 3 of the present invention distinguishes the long PN code sequence with an unique code offset shared by users of a second group which is not disclosed in Roh et al.

Therefore, now amended Claim 1 cites "a unique phase offset of that code that is shared by each user of the second group" to distinguish the unique phase offset shared by the second group of the present invention from the fixed and common phase offset disclosed in Roh et al. Support for this claim amendment is at least found in original Claim 24 and on page 11, lines 8-18 of the Specification.

As stated previously, the "code phase offset" disclosed in Zehavi refers to the same state of the long PN code sequence as the "code offset" described in Roh et al. Regardless, Zehavi also does not disclose or suggest assigning a PN spreading code with a unique code, phase, or time offset that is shared by a second group of users. Furthermore, <u>the combination of Roh et al. and Zehavi do not suggest having a second group of users share a unique code, phase, or time offset</u> for a long PN code sequence.

Because neither Roh et al. nor Zehavi disclose or suggest assigning a PN spreading code with unique code, phase, or time offset that is shared by a second group as recited in amended base Claim 1, the Office Action fails to make obvious the present invention as claimed in

amended base Claim 1. Thus, the Applicant respectfully requests that the §103 rejection of Claim 1 be withdrawn.

Because Claims 2-23 depend from and are limited by base Claim 1, the foregoing arguments against obviousness apply and the Applicant respectfully requests that the various § 103 rejections of Claims 2-23 be withdrawn.

For the same reasons as stated above, the Office Action fails to make a case of prima facie obviousness regarding now amended base Claim 24. Support for this claim amendment is at least found on page 11, lines 8-18 of the Specification. Thus, the Applicant respectfully requests that the rejection of Claim 24 be withdrawn.

Because Claims 25-36 depend from and are limited by base Claim 24, the foregoing arguments against obviousness apply and the Applicant respectfully requests that the various § 103 rejections of Claims 25-36 be withdrawn.

With regard to the § 103 rejection of Claim 36 in view of Roh et al., Zehavi, and Hiramatsu, Hiramatsu also does not suggest having a second group of users share a unique code, phase, or time offset of a long PN code sequence which is lacking from the other cited art. Thus, no combination of the cited references, including Hiramatsu, make obvious the invention as now claimed.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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